FIG. 1

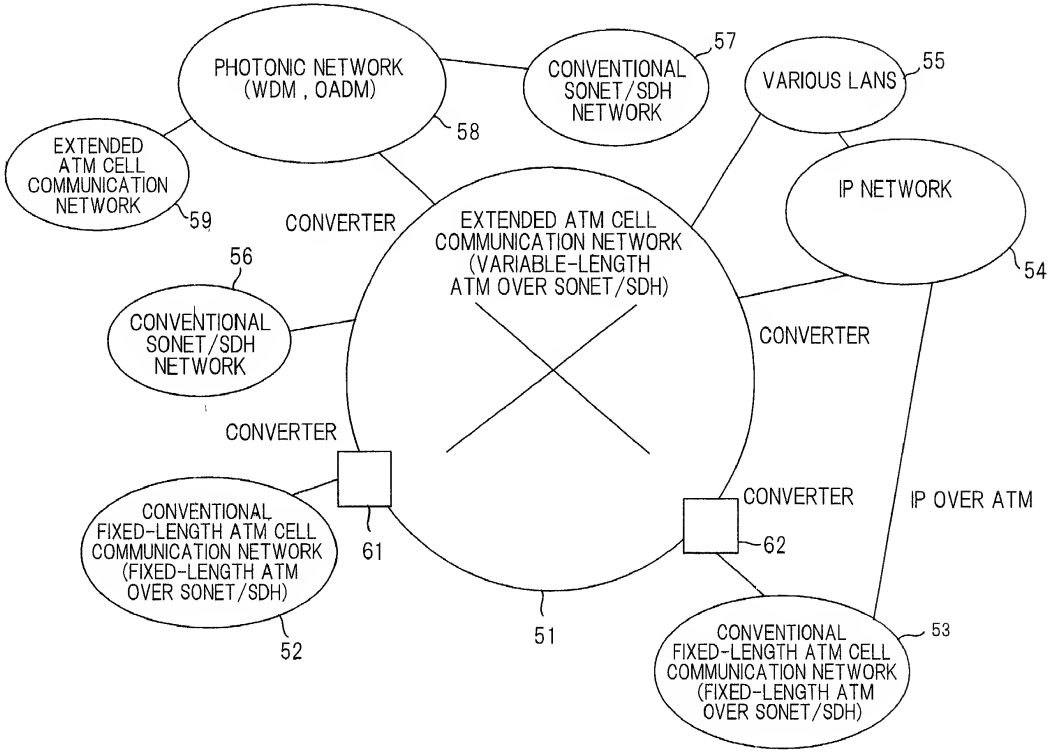

PHOTONIC NETWORK
(WDM , OADM)
58
CONVENTIONAL
SONET/SDH
NETWORK
57
VARIOUS LANS
55
EXTENDED
ATM CELL
COMMUNICATION
NETWORK
59
CONVERTER
EXTENDED ATM CELL
COMMUNICATION NETWORK
(VARIABLE-LENGTH
ATM OVER SONET/SDH)
IP NETWORK
54
56
CONVENTIONAL
SONET/SDH
NETWORK
CONVERTER
CONVERTER
CONVENTIONAL
FIXED-LENGTH ATM CELL
COMMUNICATION NETWORK
(FIXED-LENGTH ATM
OVER SONET/SDH)
52
61
CONVERTER
62
IP OVER ATM
51
CONVENTIONAL
FIXED-LENGTH ATM CELL
COMMUNICATION NETWORK
(FIXED-LENGTH ATM
OVER SONET/SDH)
53

FIG. 2

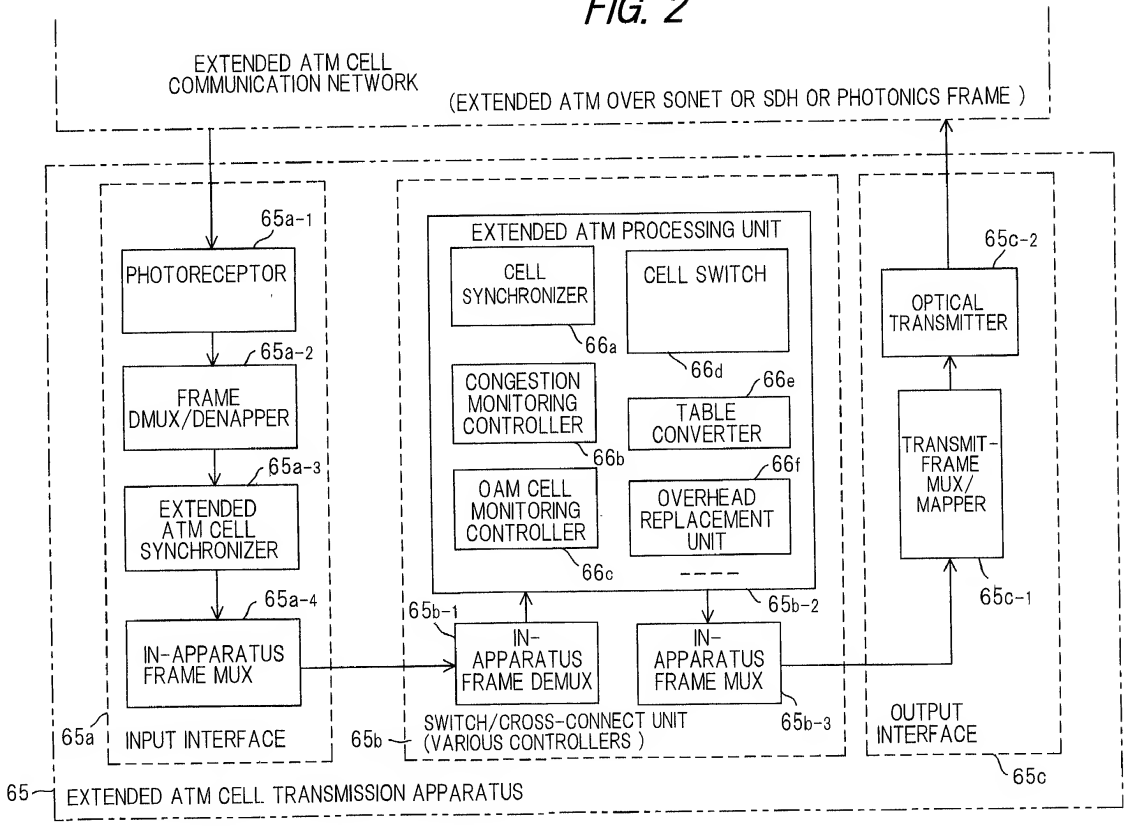

EXTENDED ATM CELL COMMUNICATION NETWORK
(EXTENDED ATM OVER SONET OR SDH OR PHOTONICS FRAME)
65a-1
PHOTORECEPTOR
65a-2
FRAME DMUX/DENAPPER
65a-3
EXTENDED ATM CELL SYNCHRONIZER
65a-4
IN-APPARATUS FRAME MUX
65a
INPUT INTERFACE
EXTENDED ATM PROCESSING UNIT
CELL SYNCHRONIZER
66a
CELL SWITCH
66d
CONGESTION MONITORING CONTROLLER
66b
66e
TABLE CONVERTER
OAM CELL MONITORING CONTROLLER
66c
66f
OVERHEAD REPLACEMENT UNIT
65b-1
IN-APPARATUS FRAME DEMUX
65b-2
IN-APPARATUS FRAME MUX
65b-3
65b
SWITCH/CROSS-CONNECT UNIT (VARIOUS CONTROLLERS)
65c-2
OPTICAL TRANSMITTER
TRANSMIT-FRAME MUX/ MAPPER
65c-1
OUTPUT INTERFACE
65c
65
EXTENDED ATM CELL TRANSMISSION APPARATUS

FIG. 3

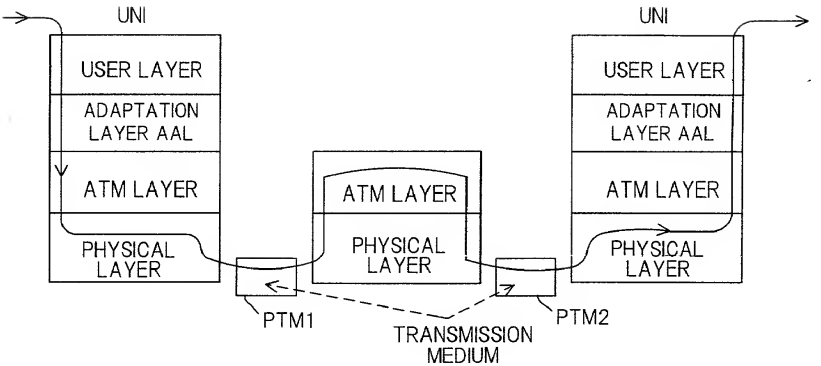
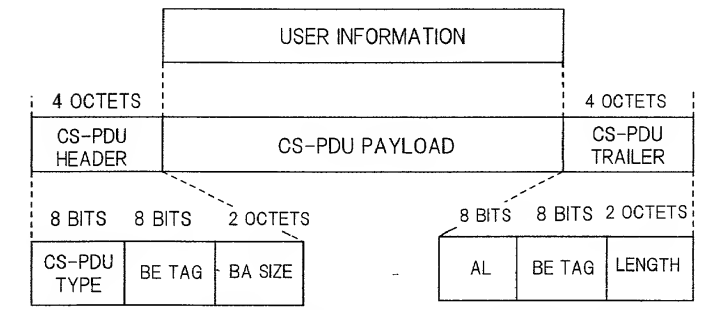
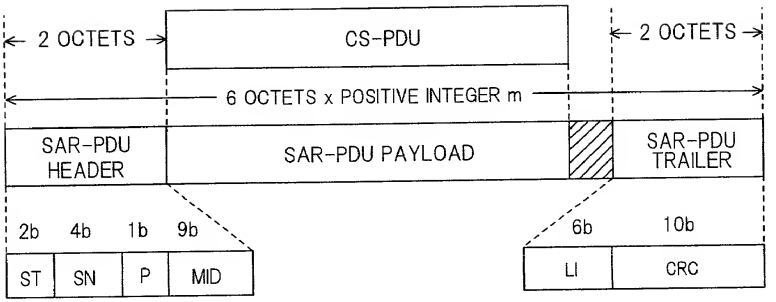


FIG. 4



BE TAG : BE TAG (HEADER, TRAILER)
AL : ALIGNMENT
BA SIZE : BUFFER ALLOCATION SIZE
LENGTH : LENGTH DISPLAY

FIG. 5



SN : SEQUENCE NO. SN ADDITION METHOD : FREE-RUN METHOD AT EACH AAL CONNECTION
LI : EFFECTIVE INFORMATION LENGTH IN PAYLOAD
CRC: CYCLIC CODE $G(X) = 1 + X + X^2 + X^5 + X^9 + X^{10}$
ST : SEGMENT TYPE (CELL-DIVIDING IDENTIFIER)
P : PRIORITY FIELD
MID : MULTIPLEX IDENTIFIER

FIG. 6A

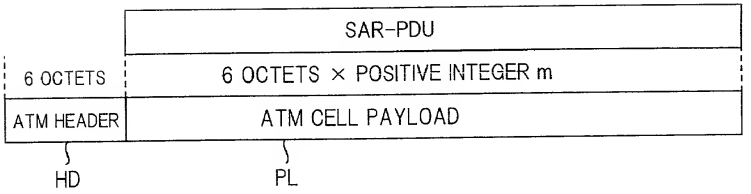
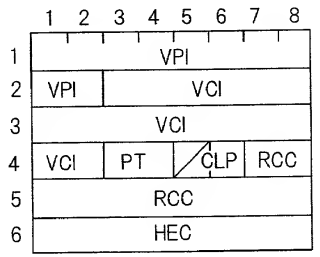


FIG. 6B



VPI : VIRTUAL PATH IDENTIFIER

VCI : VIRTUAL CANNEL IDENTIFIER

PT : PAYLOAD TYPE
00 : USER DATA
01 : TEST DATA

CLP : CELL LOSS PRIORITY
0 : LOW PRIORITY (VOICE)
1 : HIGH PRIORITY (FAX、HDLC)

RCC : ROW OF CELL COUNT
(INDICATES WHOLE-NUMBER MULTIPLE OF SIX OCTETS OF HEADER)

HEC : HEADER CHECK SEQUENCE
GENERATED POLYNOMIAL $= X^9 + X^2 + X + 1$

FIG. 7

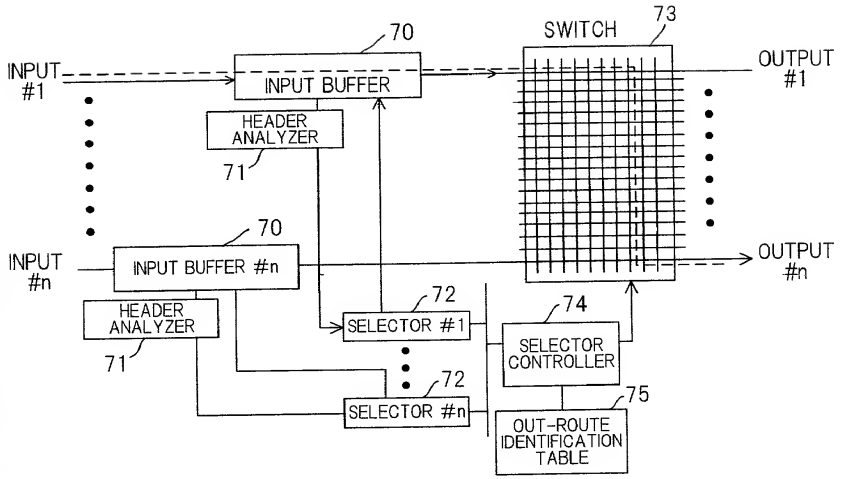

INPUT #1
INPUT BUFFER
70
SWITCH
73
OUTPUT #1
HEADER ANALYZER
71
INPUT #n
INPUT BUFFER #n
70
OUTPUT #n
HEADER ANALYZER
71
SELECTOR #1
72
SELECTOR #n
72
SELECTOR CONTROLLER
74
OUT-ROUTE IDENTIFICATION TABLE
75

FIG. 8

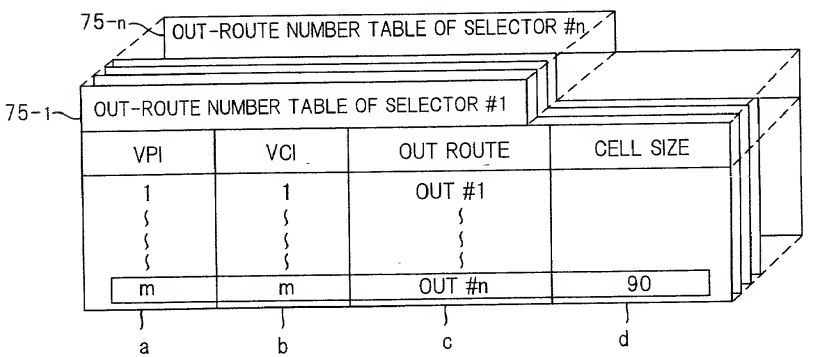

75-n
OUT-ROUTE NUMBER TABLE OF SELECTOR #n
75-1
OUT-ROUTE NUMBER TABLE OF SELECTOR #1
VPI
VCI
OUT ROUTE
CELL SIZE
1
1
OUT #1
m
m
OUT #n
90
a
b
c
d

FIG. 9A

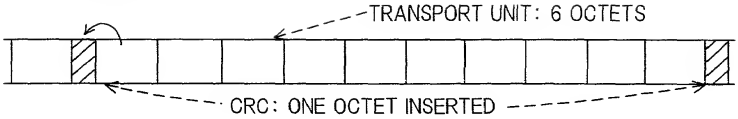

TRANSPORT UNIT: 6 OCTETS
CRC: ONE OCTET INSERTED

FIG. 9B

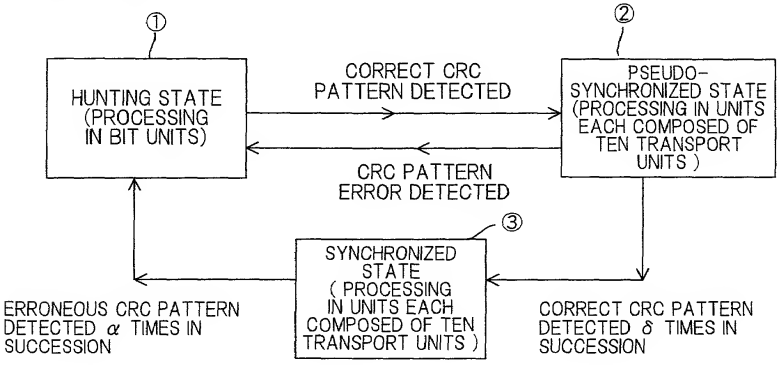

①
HUNTING STATE (PROCESSING IN BIT UNITS)
CORRECT CRC PATTERN DETECTED
②
PSEUDO-SYNCHRONIZED STATE (PROCESSING IN UNITS EACH COMPOSED OF TEN TRANSPORT UNITS)
CRC PATTERN ERROR DETECTED
③
SYNCHRONIZED STATE (PROCESSING IN UNITS EACH COMPOSED OF TEN TRANSPORT UNITS)
ERRONEOUS CRC PATTERN DETECTED α TIMES IN SUCCESSION
CORRECT CRC PATTERN DETECTED δ TIMES IN SUCCESSION

FIG. 10A

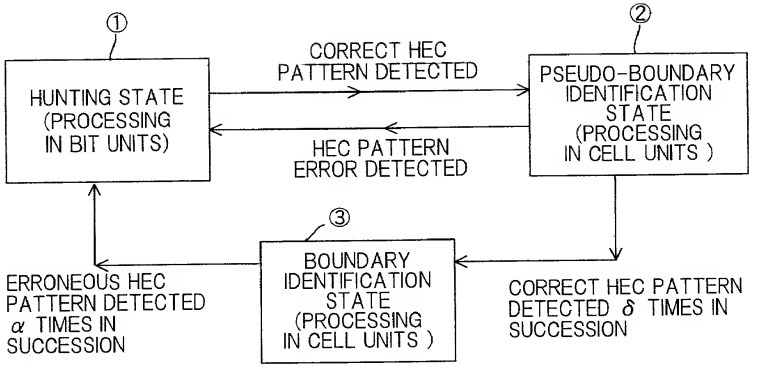


FIG. 10B

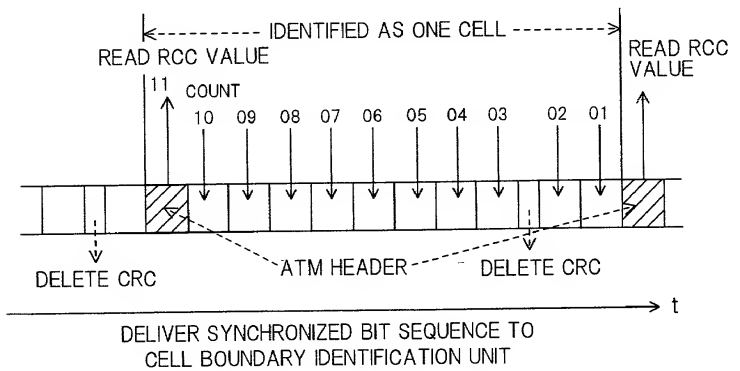


FIG. 11A

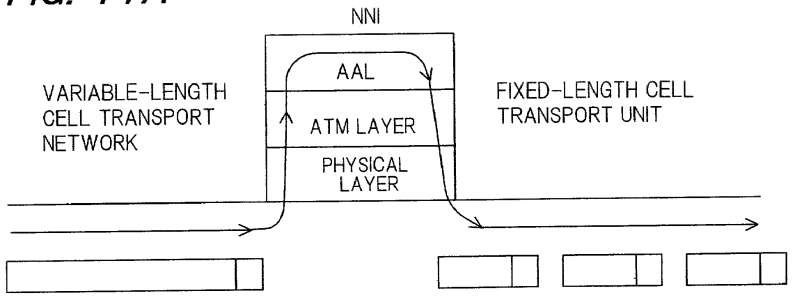


FIG. 11B

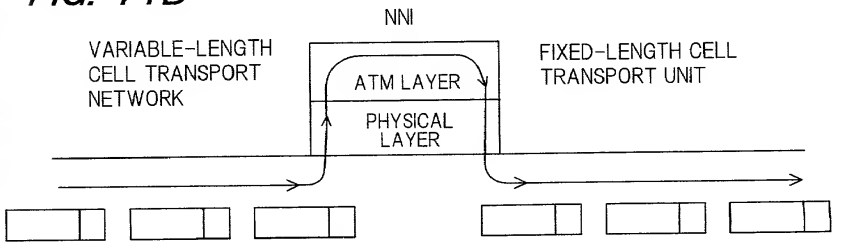


FIG. 12

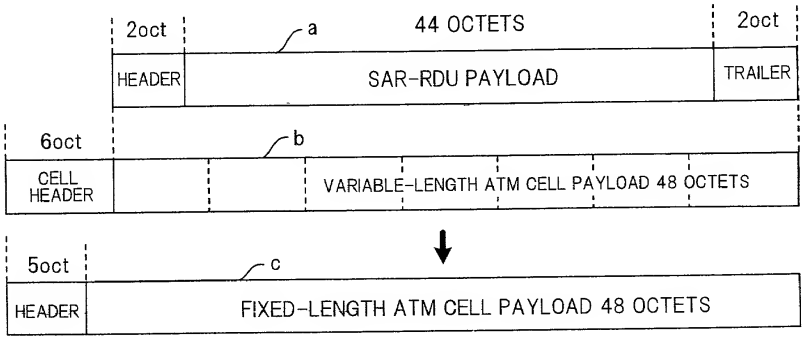


FIG. 13

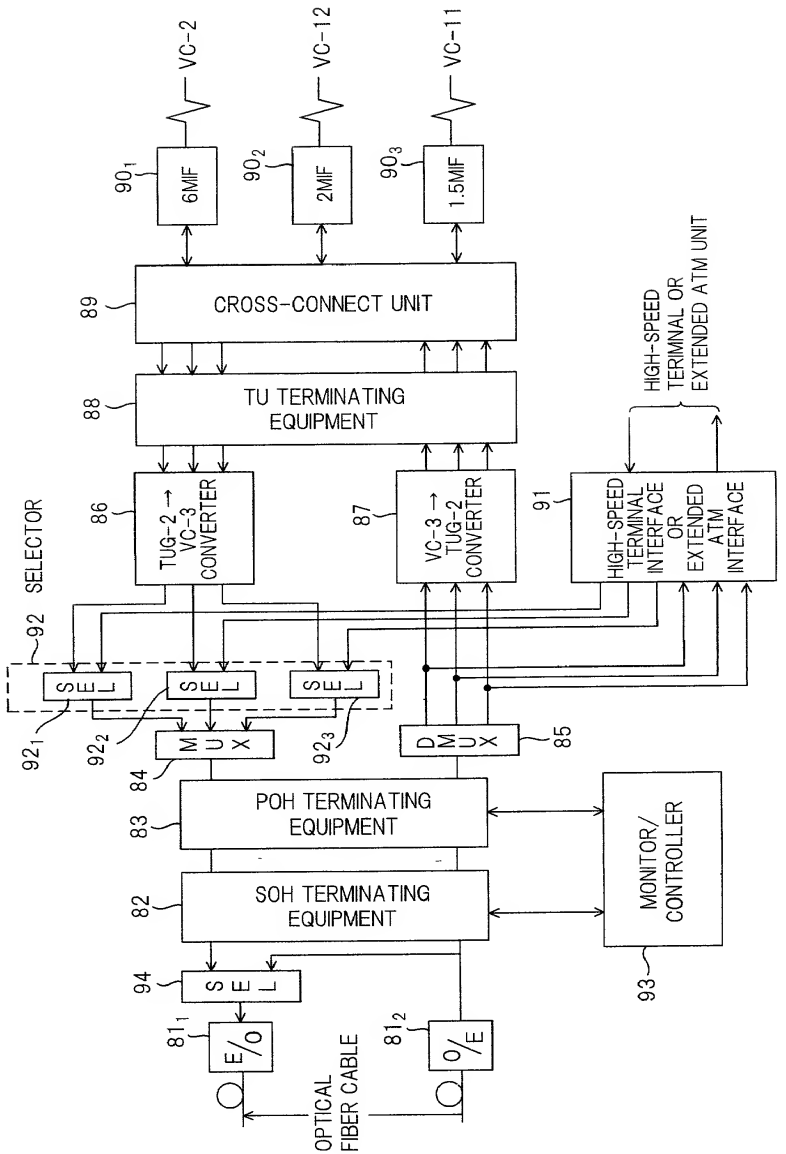

VC-2
VC-12
VC-11
90_1
6MIF
90_2
2MIF
90_3
1.5MIF
89
CROSS-CONNECT UNIT
88
TU TERMINATING EQUIPMENT
86
TUG-2 → VC-3 CONVERTER
87
VC-3 → TUG-2 CONVERTER
91
HIGH-SPEED TERMINAL INTERFACE OR EXTENDED ATM INTERFACE
HIGH-SPEED TERMINAL OR EXTENDED ATM UNIT
92 SELECTOR
SEL
92_1
92_2
92_3
MUX
84
DMUX
85
83
POH TERMINATING EQUIPMENT
82
SOH TERMINATING EQUIPMENT
MONITOR/ CONTROLLER
93
94
81_1
E/O
81_2
O/E
OPTICAL FIBER CABLE

FIG. 14

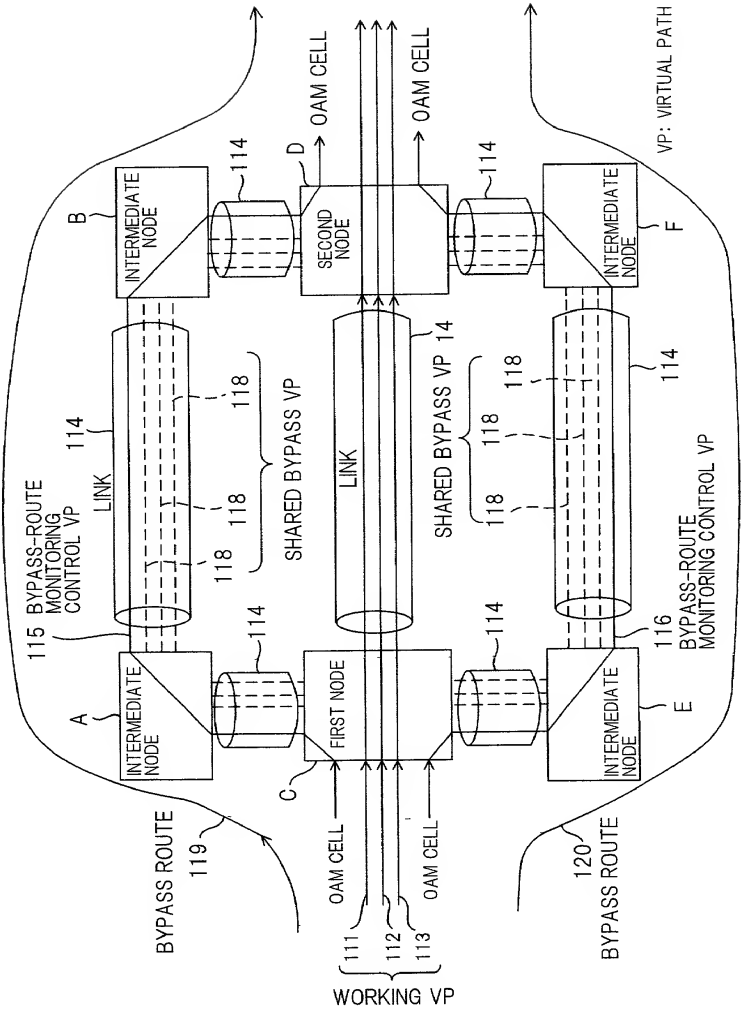

BYPASS ROUTE
119
WORKING VP
111
112
113
OAM CELL
OAM CELL
C
FIRST NODE
A
INTERMEDIATE NODE
115 BYPASS-ROUTE MONITORING CONTROL VP
LINK
114
118
SHARED BYPASS VP
LINK
SHARED BYPASS VP 14
B
INTERMEDIATE NODE
D
SECOND NODE
OAM CELL
OAM CELL
E
INTERMEDIATE NODE
F
INTERMEDIATE NODE
116 BYPASS-ROUTE MONITORING CONTROL VP
120
BYPASS ROUTE
VP: VIRTUAL PATH

FIG. 15

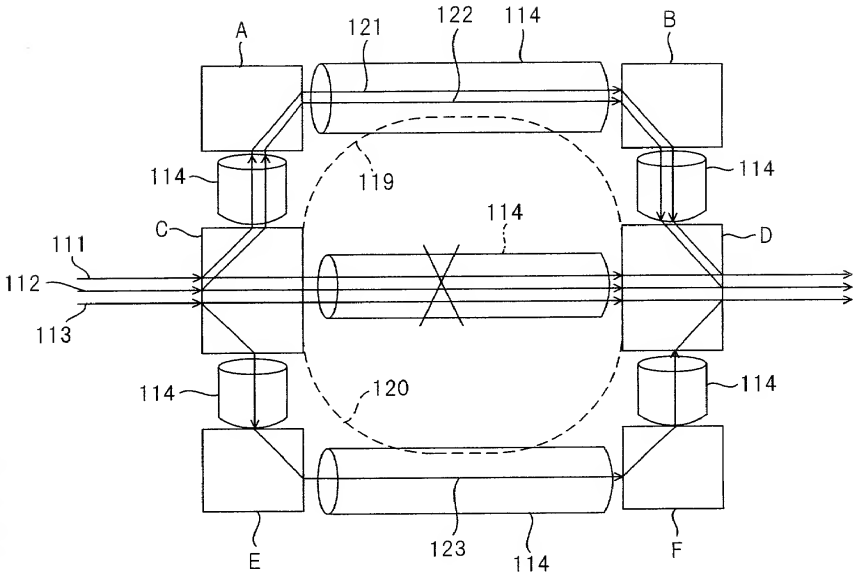

A
121
122
114
B
114
119
114
C
D
111
112
113
114
120
114
E
123
114
F

FIG. 16

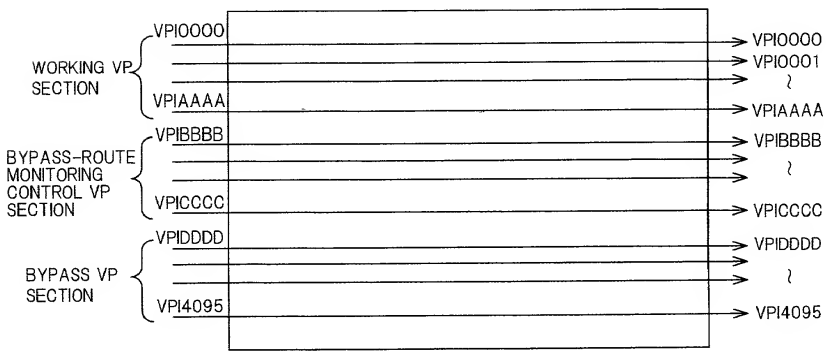

WORKING VP SECTION
VPI0000
VPIAAAA
BYPASS-ROUTE MONITORING CONTROL VP SECTION
VPIBBBB
VPICCCC
BYPASS VP SECTION
VPIDDDD
VPI4095
VPI0000
VPI0001
VPIAAAA
VPIBBBB
VPICCCC
VPIDDDD
VPI4095

FIG. 17

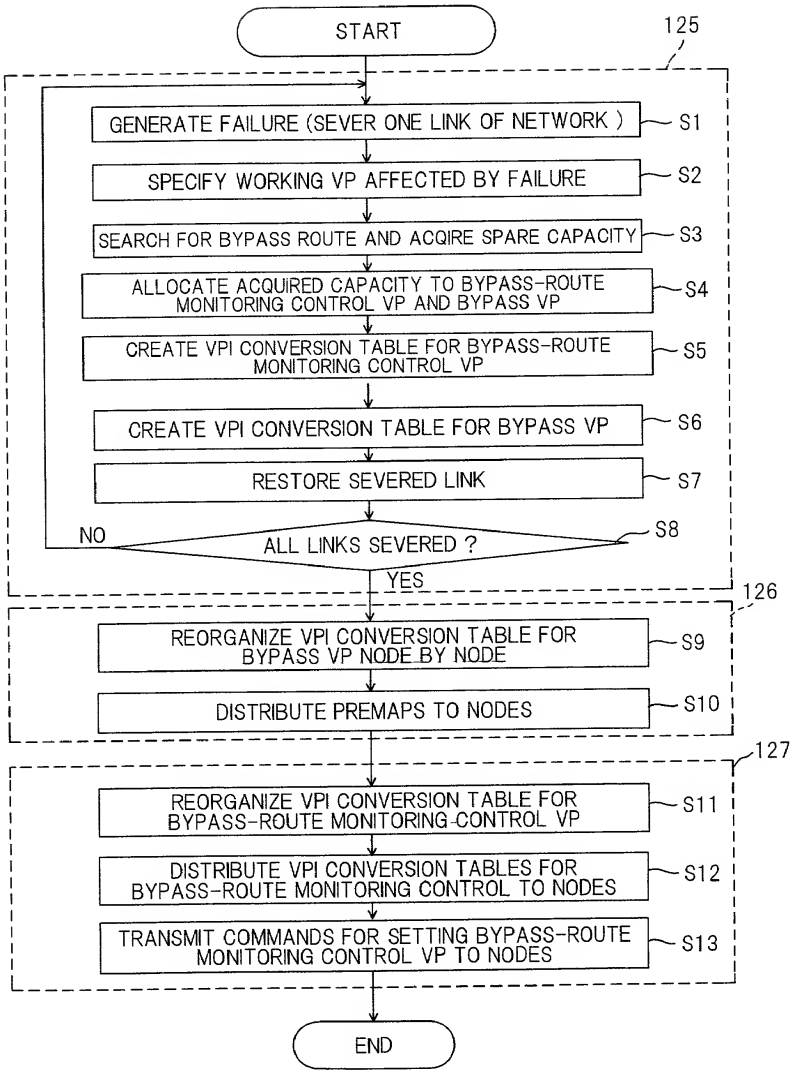

START
125
GENERATE FAILURE (SEVER ONE LINK OF NETWORK)
S1
SPECIFY WORKING VP AFFECTED BY FAILURE
S2
SEARCH FOR BYPASS ROUTE AND ACQIRE SPARE CAPACITY
S3
ALLOCATE ACQUIRED CAPACITY TO BYPASS-ROUTE MONITORING CONTROL VP AND BYPASS VP
S4
CREATE VPI CONVERSION TABLE FOR BYPASS-ROUTE MONITORING CONTROL VP
S5
CREATE VPI CONVERSION TABLE FOR BYPASS VP
S6
RESTORE SEVERED LINK
S7
NO
ALL LINKS SEVERED ?
S8
YES
126
REORGANIZE VPI CONVERSION TABLE FOR BYPASS VP NODE BY NODE
S9
DISTRIBUTE PREMAPS TO NODES
S10
127
REORGANIZE VPI CONVERSION TABLE FOR BYPASS-ROUTE MONITORING CONTROL VP
S11
DISTRIBUTE VPI CONVERSION TABLES FOR BYPASS-ROUTE MONITORING CONTROL TO NODES
S12
TRANSMIT COMMANDS FOR SETTING BYPASS-ROUTE MONITORING CONTROL VP TO NODES
S13
END

FIG. 18

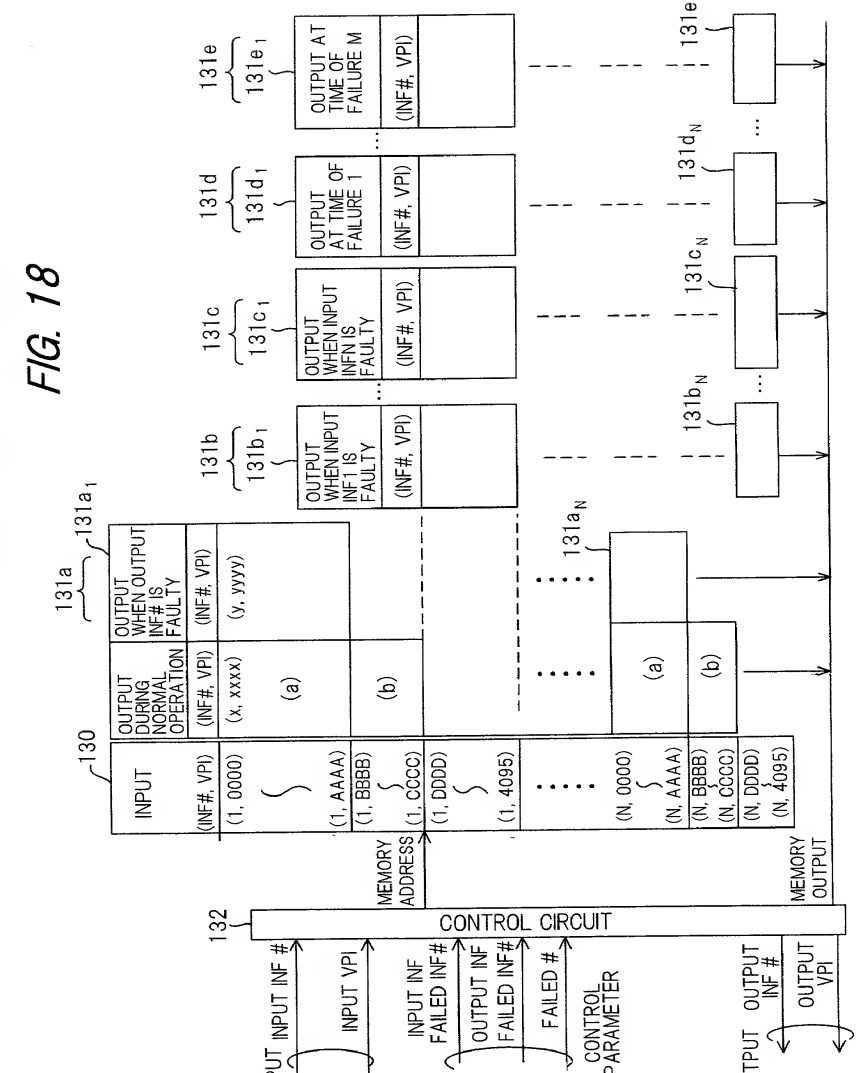

130
INPUT
(INF#, VPI)
(1, 0000)
(1, AAAA)
(1, BBBB)
(1, CCCC)
(1, DDDD)
(1, 4095)
(N, 0000)
(N, AAAA)
(N, BBBB)
(N, CCCC)
(N, DDDD)
(N, 4095)
131a
131a1
OUTPUT DURING NORMAL OPERATION
(INF#, VPI)
(x, xxxx)
(a)
(b)
OUTPUT WHEN OUTPUT INF# IS FAULTY
(INF#, VPI)
(y, yyyy)
131a_N
131b
131b1
OUTPUT WHEN INPUT INF1 IS FAULTY
(INF#, VPI)
131b_N
131c
131c1
OUTPUT WHEN INPUT INFN IS FAULTY
(INF#, VPI)
131c_N
131d
131d1
OUTPUT AT TIME OF FAILURE 1
(INF#, VPI)
131d_N
131e
131e1
OUTPUT AT TIME OF FAILURE M
(INF#, VPI)
131e_N
MEMORY ADDRESS
MEMORY OUTPUT
132
CONTROL CIRCUIT
INPUT INPUT INF #
INPUT VPI
INPUT INF FAILED INF#
OUTPUT INF FAILED INF#
FAILED #
CONTROL PARAMETER
OUTPUT OUTPUT INF #
OUTPUT VPI

FIG. 19

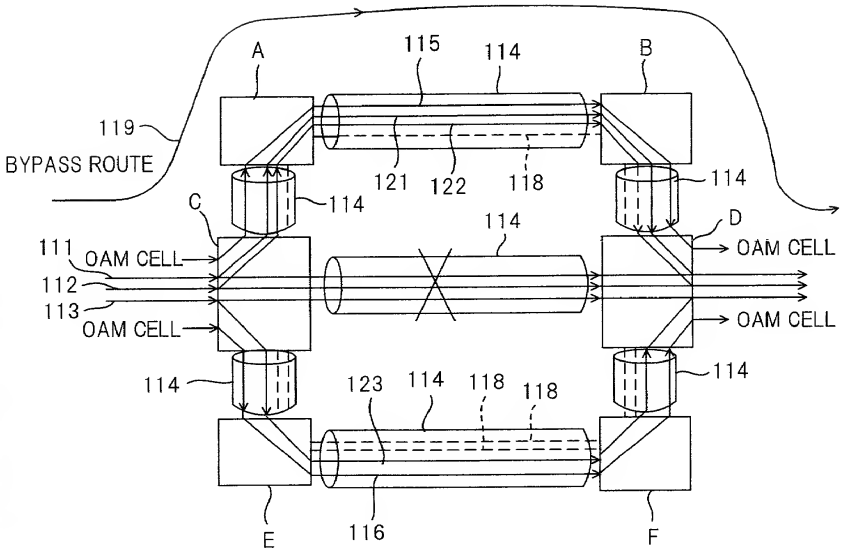

A
115
114
B
119
BYPASS ROUTE
121
122
118
114
C
114
114
D
111
OAM CELL
OAM CELL
112
113
OAM CELL
114
123
114
118
118
114
E
116
F

FIG. 20

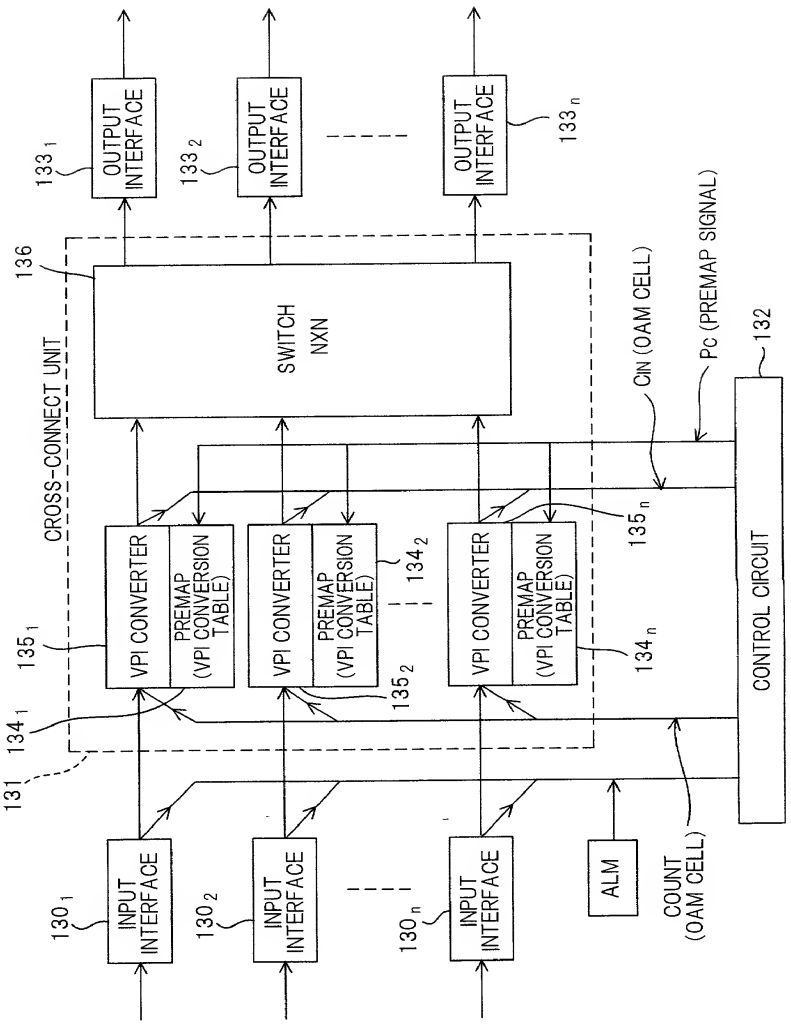

131
CROSS-CONNECT UNIT
136
SWITCH
NXN
133_1
133_2
133_n
OUTPUT INTERFACE
OUTPUT INTERFACE
OUTPUT INTERFACE
135_1
135_2
135_n
VPI CONVERTER
PREMAP (VPI CONVERSION TABLE)
VPI CONVERTER
PREMAP (VPI CONVERSION TABLE)
VPI CONVERTER
PREMAP (VPI CONVERSION TABLE)
134_1
134_2
134_n
130_1
130_2
130_n
INPUT INTERFACE
INPUT INTERFACE
INPUT INTERFACE
ALM
COUNT (OAM CELL)
CIN (OAM CELL)
PC (PREMAP SIGNAL)
132
CONTROL CIRCUIT

FIG. 21

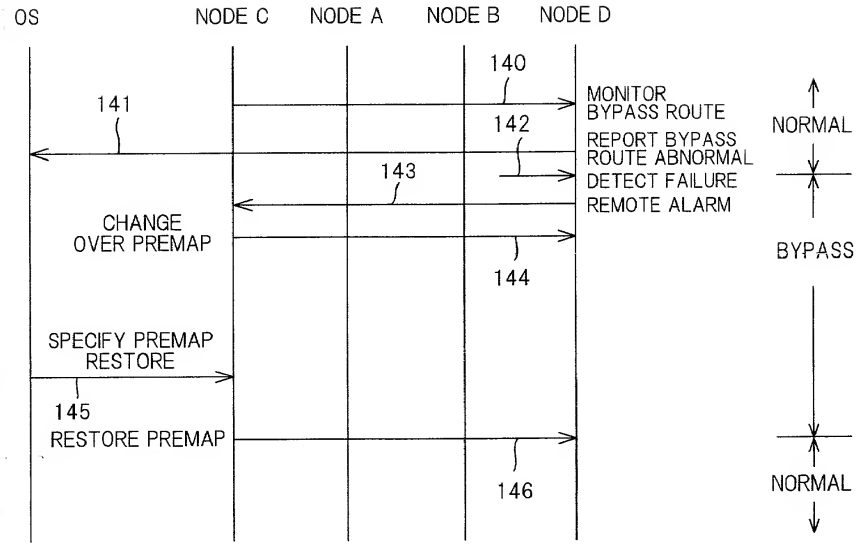

OS
NODE C
NODE A
NODE B
NODE D
140
MONITOR BYPASS ROUTE
141
142
REPORT BYPASS ROUTE ABNORMAL
143
DETECT FAILURE
REMOTE ALARM
CHANGE OVER PREMAP
144
SPECIFY PREMAP RESTORE
145
RESTORE PREMAP
146
NORMAL
BYPASS
NORMAL

FIG. 22

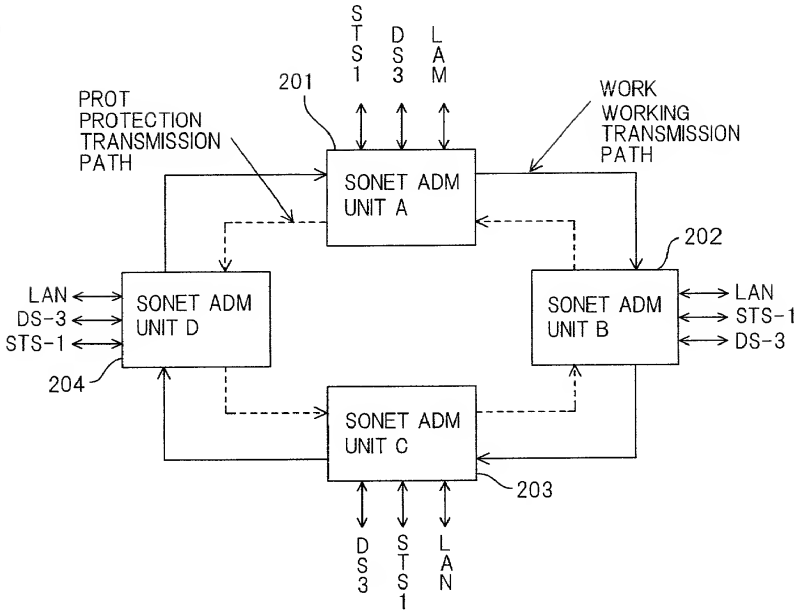

STS1
DS3
LAM
201
PROT
PROTECTION
TRANSMISSION
PATH
WORK
WORKING
TRANSMISSION
PATH
SONET ADM
UNIT A
202
LAN
DS-3
STS-1
SONET ADM
UNIT D
SONET ADM
UNIT B
LAN
STS-1
DS-3
204
SONET ADM
UNIT C
203
DS3
STS1
LAN

FIG. 23

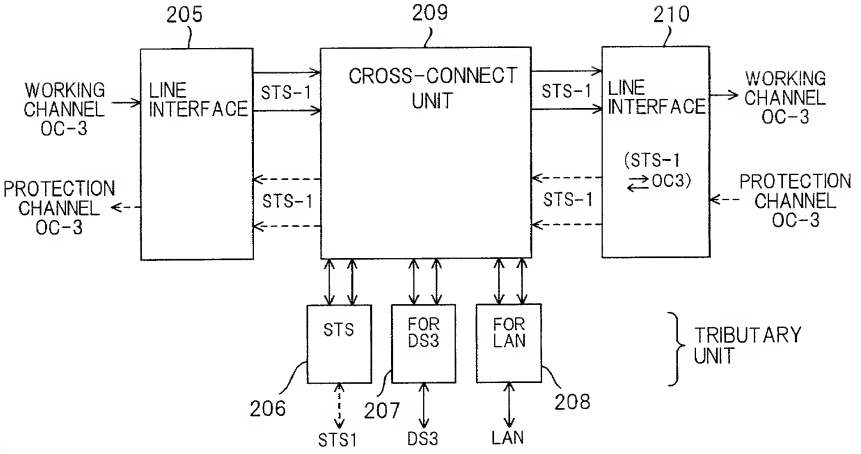

205
209
210
WORKING CHANNEL OC-3
LINE INTERFACE
STS-1
CROSS-CONNECT UNIT
STS-1
LINE INTERFACE
WORKING CHANNEL OC-3
PROTECTION CHANNEL OC-3
STS-1
STS-1
(STS-1 ⇄OC3)
PROTECTION CHANNEL OC-3
STS
FOR DS3
FOR LAN
TRIBUTARY UNIT
206
207
208
STS1
DS3
LAN

FIG. 24

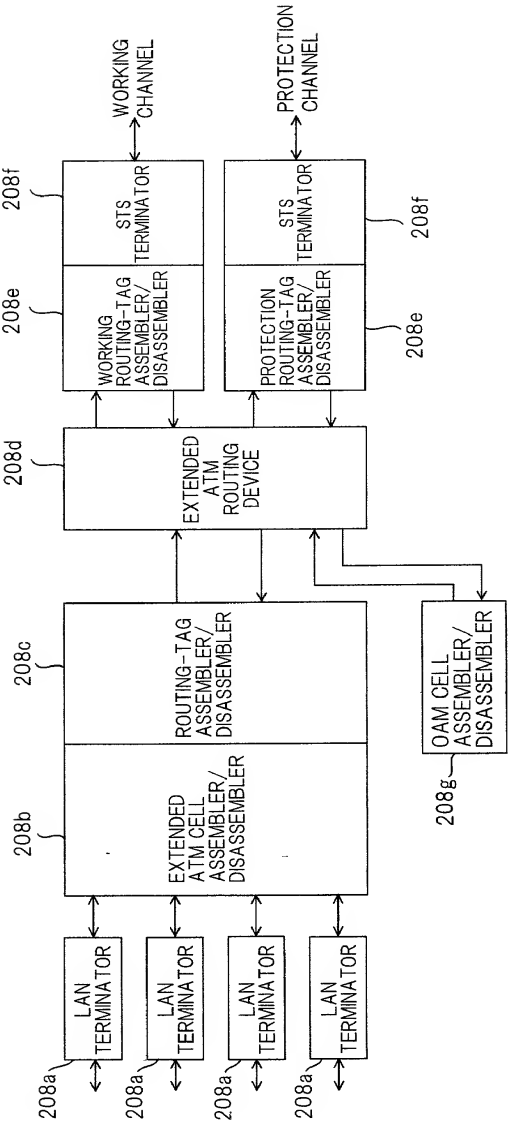
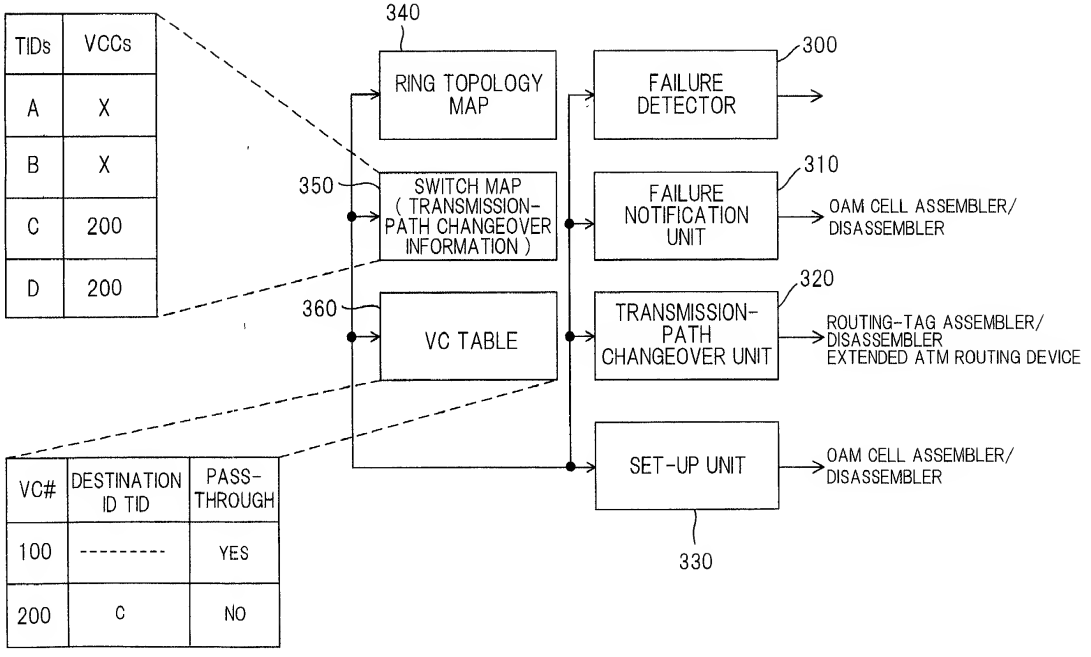

WORKING CHANNEL
PROTECTION CHANNEL
208f
208e
208d
208c
208b
208a
208g
STS TERMINATOR
WORKING ROUTING-TAG ASSEMBLER/ DISASSEMBLER
PROTECTION ROUTING-TAG ASSEMBLER/ DISASSEMBLER
EXTENDED ATM ROUTING DEVICE
ROUTING-TAG ASSEMBLER/ DISASSEMBLER
EXTENDED ATM CELL ASSEMBLER/ DISASSEMBLER
OAM CELL ASSEMBLER/ DISASSEMBLER
LAN TERMINATOR

FIG. 25


TIDs
VCCs
A
X
B
X
C
200
D
200
340
RING TOPOLOGY MAP
350
SWITCH MAP (TRANSMISSION-PATH CHANGEOVER INFORMATION)
360
VC TABLE
300
FAILURE DETECTOR
310
FAILURE NOTIFICATION UNIT
OAM CELL ASSEMBLER/ DISASSEMBLER
320
TRANSMISSION-PATH CHANGEOVER UNIT
ROUTING-TAG ASSEMBLER/ DISASSEMBLER EXTENDED ATM ROUTING DEVICE
SET-UP UNIT
OAM CELL ASSEMBLER/ DISASSEMBLER
330
VC#
DESTINATION ID TID
PASS-THROUGH
100

YES
200
C
NO

FIG. 26

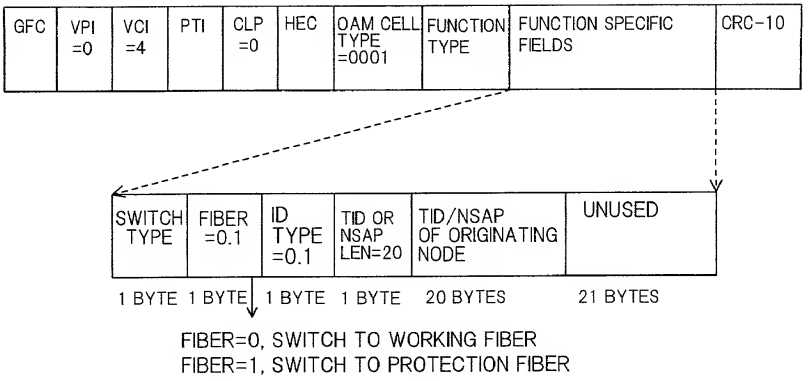

GFC
VPI =0
VCI =4
PTI
CLP =0
HEC
OAM CELL TYPE =0001
FUNCTION TYPE
FUNCTION SPECIFIC FIELDS
CRC-10
SWITCH TYPE
FIBER =0.1
ID TYPE =0.1
TID OR NSAP LEN=20
TID/NSAP OF ORIGINATING NODE
UNUSED
1 BYTE
1 BYTE
1 BYTE
1 BYTE
20 BYTES
21 BYTES
FIBER=0, SWITCH TO WORKING FIBER
FIBER=1, SWITCH TO PROTECTION FIBER

FIG. 27

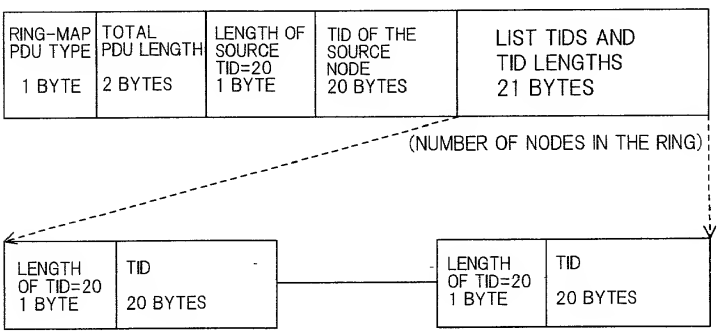

RING-MAP PDU TYPE
1 BYTE
TOTAL PDU LENGTH
2 BYTES
LENGTH OF SOURCE TID=20
1 BYTE
TID OF THE SOURCE NODE
20 BYTES
LIST TIDS AND TID LENGTHS
21 BYTES
(NUMBER OF NODES IN THE RING)
LENGTH OF TID=20
1 BYTE
TID
20 BYTES
LENGTH OF TID=20
1 BYTE
TID
20 BYTES

FIG. 28

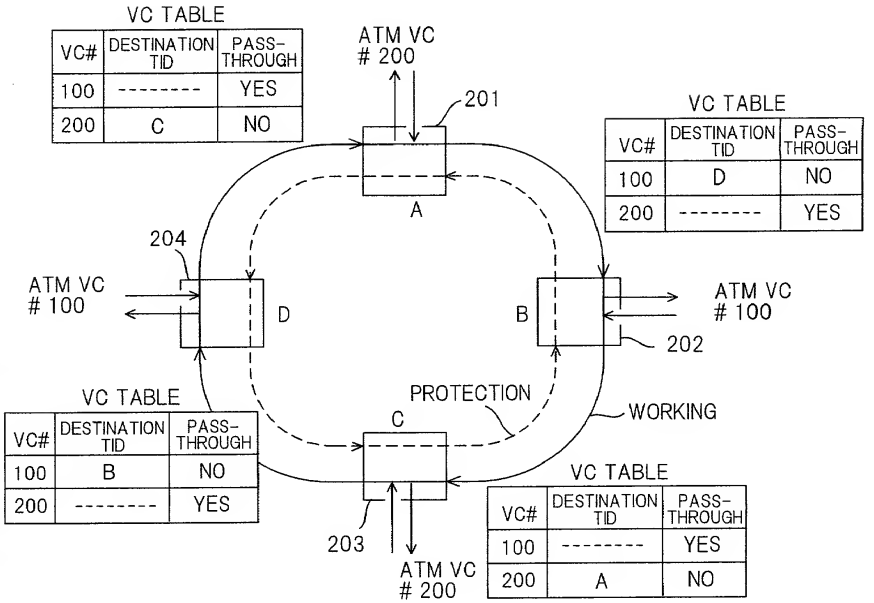

VC TABLE
VC# | DESTINATION TID | PASS-THROUGH
100 | -------- | YES
200 | C | NO
ATM VC # 200
201
A
VC TABLE
VC# | DESTINATION TID | PASS-THROUGH
100 | D | NO
200 | -------- | YES
204
ATM VC # 100
D
B
ATM VC # 100
202
VC TABLE
VC# | DESTINATION TID | PASS-THROUGH
100 | B | NO
200 | -------- | YES
PROTECTION
WORKING
C
VC TABLE
VC# | DESTINATION TID | PASS-THROUGH
100 | -------- | YES
200 | A | NO
203
ATM VC # 200

FIG. 29

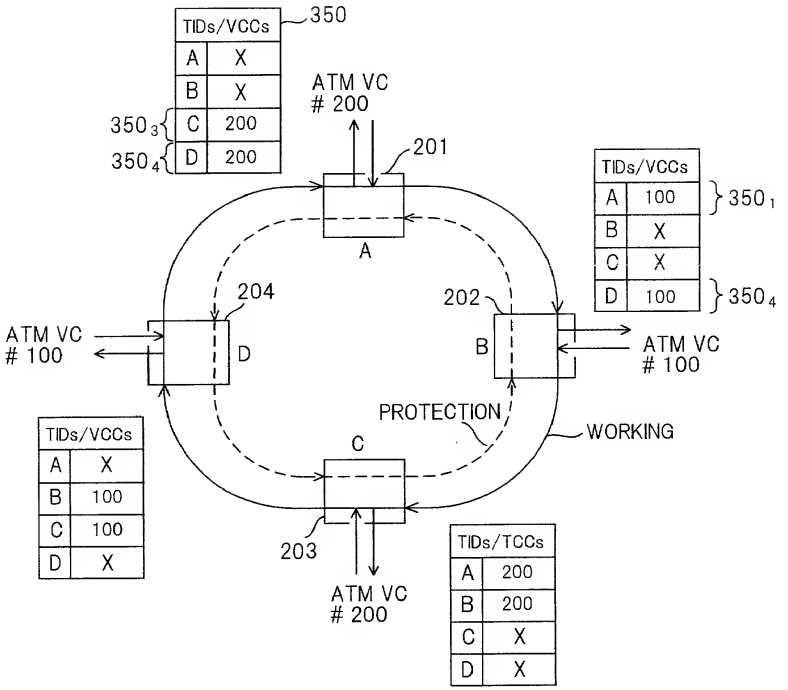

TIDs/VCCs
A X
B X
C 200
D 200
350
350 3
350 4
ATM VC
200
201
A
TIDs/VCCs
A 100
B X
C X
D 100
350 1
350 4
204
202
ATM VC
100
D
B
ATM VC
100
PROTECTION
WORKING
C
TIDs/VCCs
A X
B 100
C 100
D X
203
ATM VC
200
TIDs/TCCs
A 200
B 200
C X
D X

FIG. 30

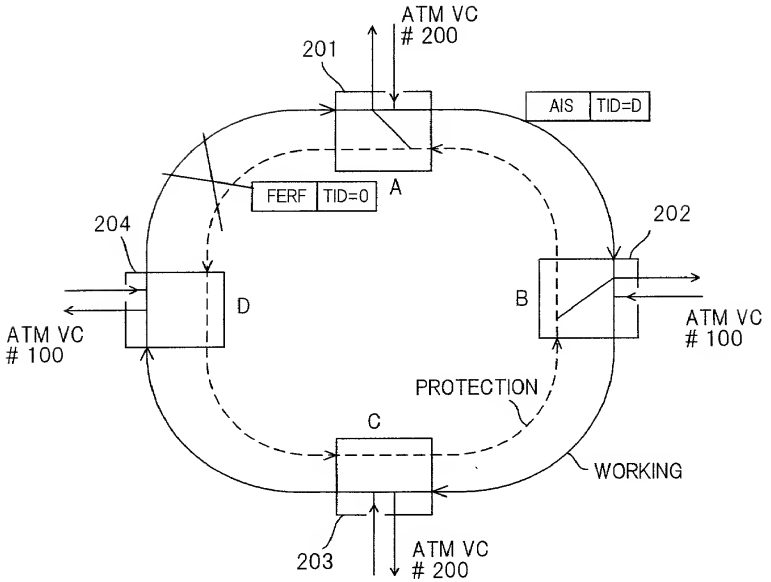

ATM VC
200
201
AIS
TID=D
FERF
TID=0
A
204
202
D
B
ATM VC
100
ATM VC
100
PROTECTION
C
WORKING
203
ATM VC
200

FIG. 31 PRIOR ART

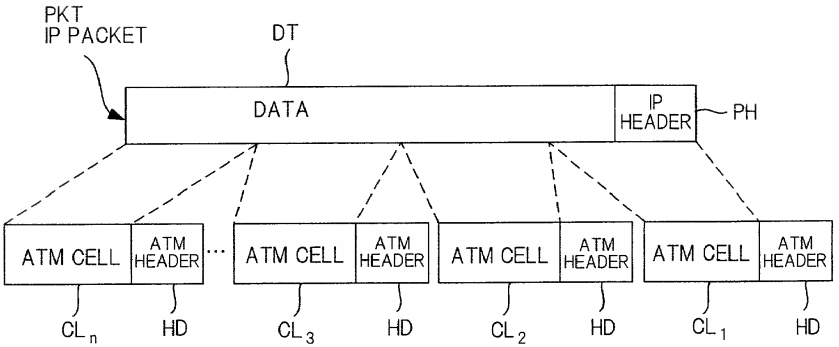


FIG. 32 PRIOR ART

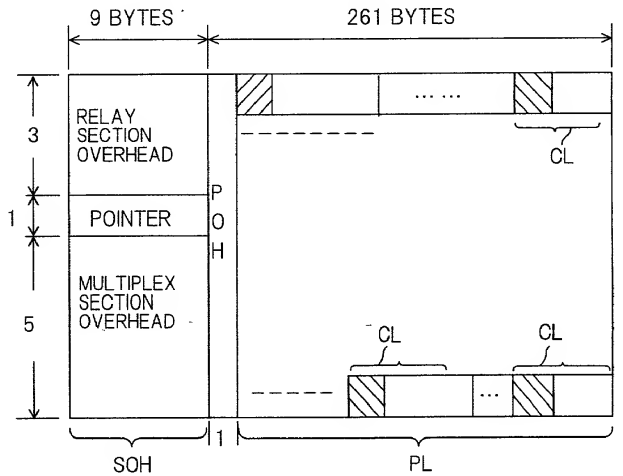


FIG. 33 PRIOR ART

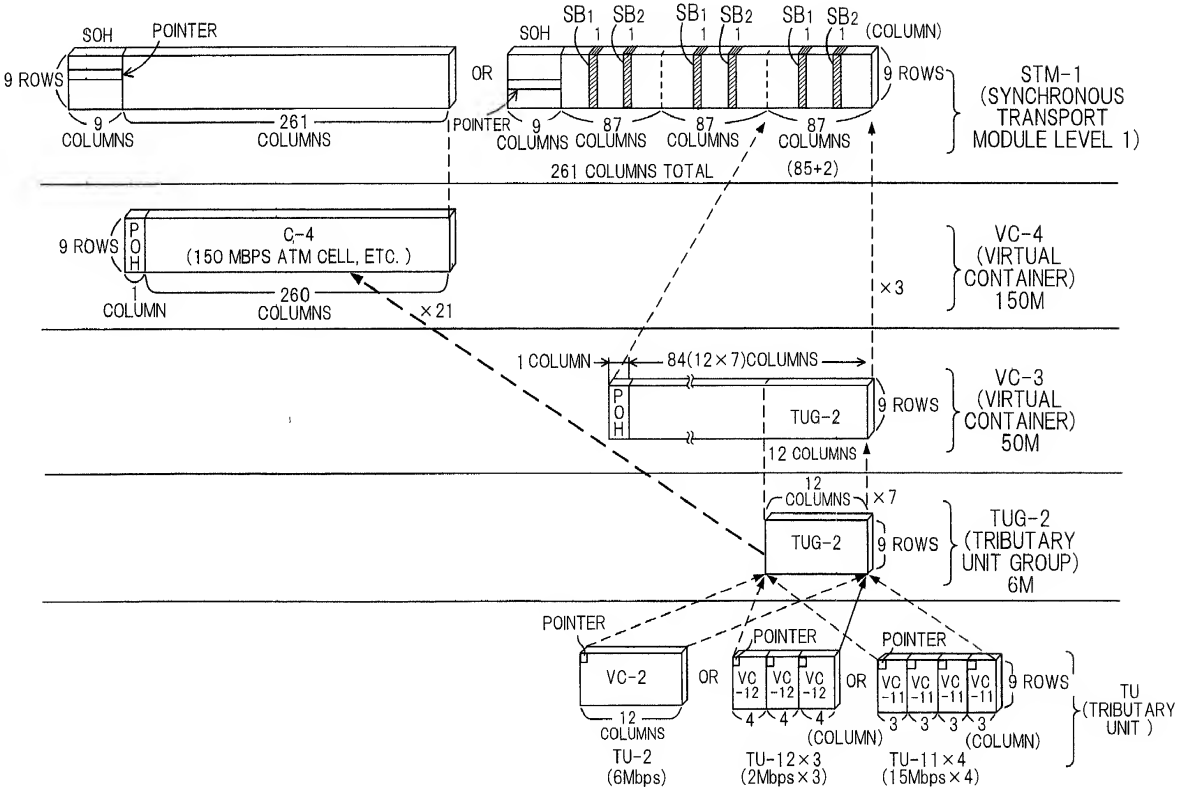


FIG. 34 PRIOR ART

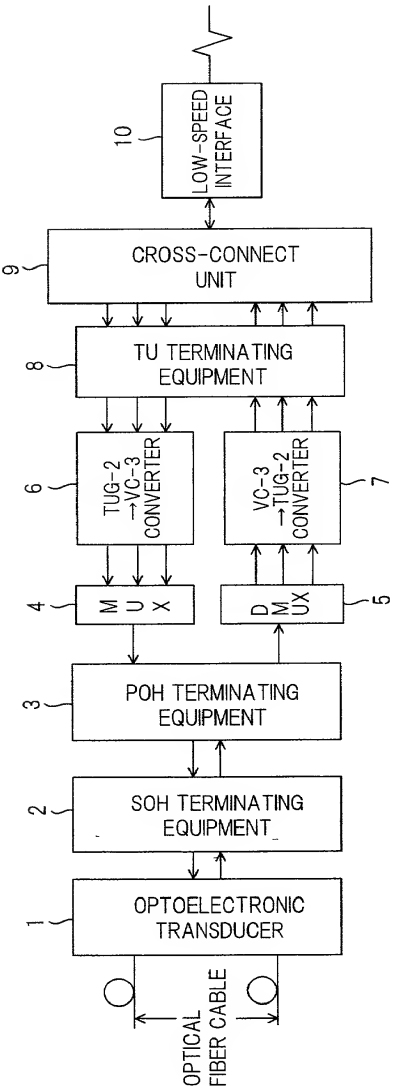


FIG. 35 PRIOR ART

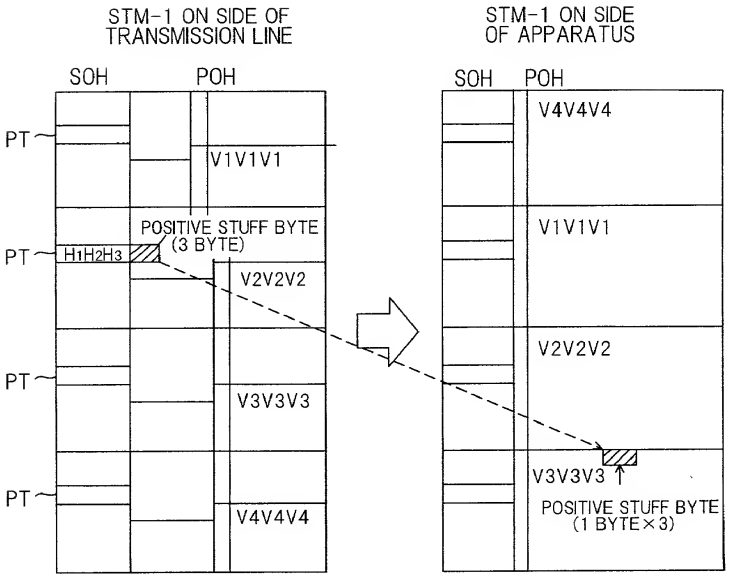


FIG. 36 PRIOR ART

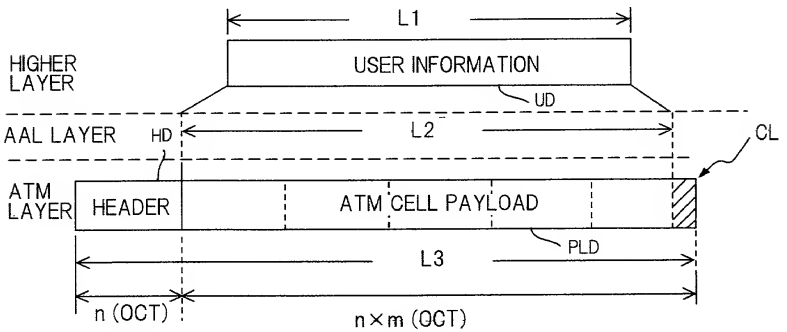


FIG. 37 PRIOR ART

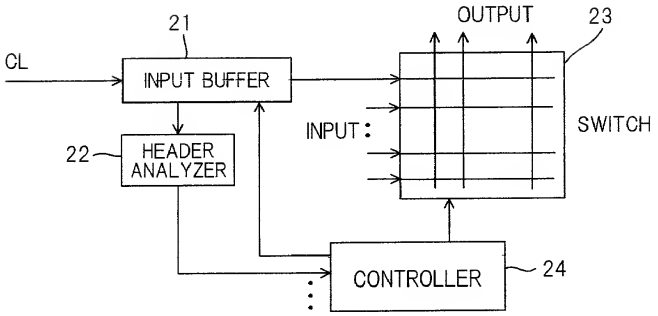


FIG. 38 PRIOR ART

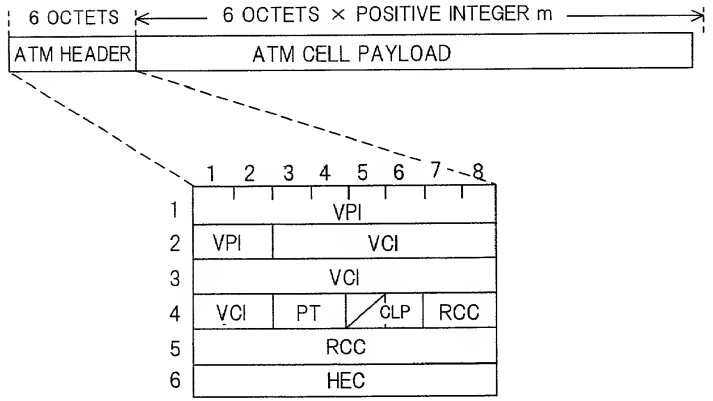


FIG. 39 PRIOR ART

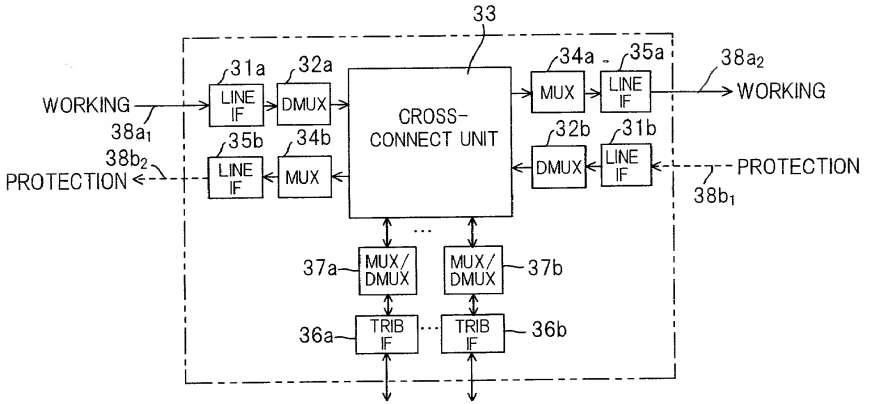
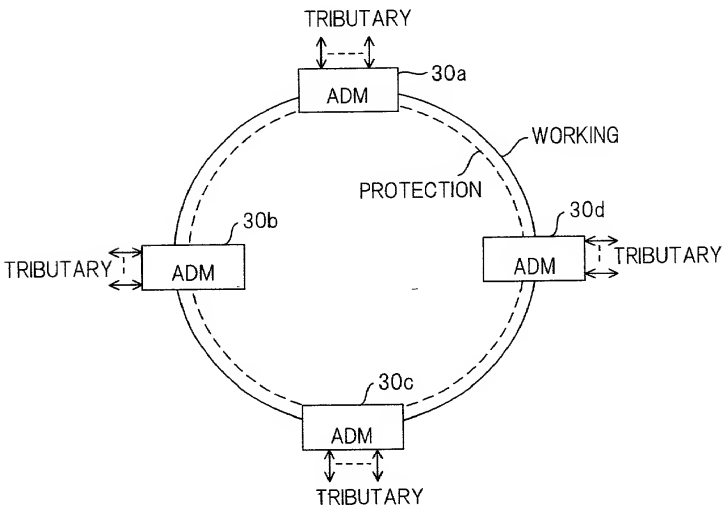



FIG. 40 PRIOR ART